Unit 12 Barratt Trading Estate, Denmore Road, Bridge of Don, Aberdeen AB23 8JW

User Manual

Liquid Seal S-Box

This Manual Covers the Following Part Numbers:

137-4856-HV0

Table of Contents

1 Safety v
2 Introduction 1
2.1 General 1
2.2 Product Identification 1
3 Technical Specification 2
4 Technical Description 4
4.1 Description 4
4.2 Packing Stick 5
4.3 Blow out plug 6
4.4 Easy Assembly 6
5 Operation 7
5.1 Packing Stick fitting/replacement 7
5.2 Pre Job 7
5.3 During Job 7
5.4 Post Job 9
6 Maintenance 10
6.1 Introduction 10
6.2 Schedule 10
6.3 Safety 10
6.4 Tools 11
6.5 Redress Procedure 11
6.6 Maintenance Record Sheet 14
7 Testing 15
8 Parts List and Drawings 16
9 Spares 21
9.1 Individual Items 21
9.2 Support Items 21

Table 1: Technical Data 2
Table 2: Maintenance Record 14
Table 3: Parts List 137-4856-HV0 17
Table 4: Parts List 100-5245-HV0 20
Table 5: Redress Kit Part No RDK-4856-HH0 21

Figure 1: Liquid Seal Stuffing Box Safety v
Figure 2: Technical Specification 3
Figure 3: Pressure gradient inside the flow tube assembly 4
Figure 4: Couettes flow equation 5
Figure 5: Assembly Instruction – part 1 12
Figure 6: Assembly Instruction – part 2 13
Figure 7: Liquid Seal Stuffing Box Assembly 1 18
Figure 8: Liquid Seal Stuffing Box Assembly 2 19
Figure 9: 100-5245-HV0 Assembly 20

Revision History

Issue, Release Date	Description
Rev A, 17 Jul. 12	Initial Issue
Rev B, 26 Nov. 12	Drawings Updated
Rev C, 13 Feb. 13	BOM's Updated

DECLARATION OF CONFORMITY

Phuel Oil Tools Limited hereby declare that the following equipment

Slickline Stuffing Box

Model 100-2040-HH0
Model 100-3296-HV0
Model 100-3602-HV0
Model 100-4229-HV0
Model 100-4269-HV0
Model 100-4336-HV0
Model 137-4429-HV0
Model 137-4856-HV0

Also described as;

A mechanical device used for guiding Slicklines (Wire-lines) into well bores while containing well bore pressure *(excluded from the Pressure Equipment Directive by virtue of Annex 'A' 6 and 9)* and is manufactured to achieve the following specification.

Top Level Assembly No	Connection Size	Working Pressure (Psi)	Overall Weight	Wheel and Hub	Overall Length (Dim A)	Make-Up Length (Dim B)
100-2040-HH0	5 ¾"	10,000	125 lbs / 57 kg	18" Std	40.1"	36"
100-3296-HV0	5 ¾" (DW)	10,000	128 lbs / 58 kg	20" Hinged	42"	38.2"
100-3602-HV0	6 ½"	10,000	128 lbs / 58 kg	18" Std	42.3"	38.5"
100-4336-HV0	4 ¾"	10,000	103 lbs / 47 kg	18" Std	40"	37.8"
100-4269-HV0	5"	6,500	99 lbs / 45 kg	18" Std	39.8"	37.3"
100-4229-HV0	5 ¾"	10,000	128 lbs / 58 kg	20" Std	42"	38.2"
137-4429-HV0	8 3/4"	15,000	282 lbs / 128 kg	N/A	41.3"	38.3"
137-4856-HV0	7"	15,000	258 lbs / 117 kg	20" Std	59.08"	56.55"

Was found to be in accordance with;

The European Machinery Directive 98/37/EC being implemented in the United Kingdom by the Supply of Machinery (Safety) Regulations 1992 and as amended by S.I. 1992/3073, S.I 1994/2063 and SI 2005/831

And the;

The European Directive on Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres 94/9/EC, being implemented in the United Kingdom by The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 (SI 1996/192) and as amended by The Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres (Amendment) Regulations 2001 (SI 2001 No.3766).

DECLARATION OF CONFORMITY

This equipment was designed to meet with the following European Harmonised Standards;

BS EN ISO 12100 Part 1 Safety of Machinery. Basic concepts, general principles for design
BS EN ISO 12100 Part 2 Safety of Machinery. Technical principles
BS EN 13463 Part 1: Non-electrical Equipment Intended for Use in Potentially Explosive Atmospheres - Basic Method and Requirements.
BS EN 13463 Part 5: Non-electrical equipment intended for use in potentially explosive atmospheres - Protection by constructional safety c.
BS EN 982 Safety of Machinery – Safety Requirements for Fluid Power Systems and Their Components - Hydraulics
BS EN 1050 Safety of Machinery – Principles for Risk Assessment

This equipment has been classified as suitable for use within a potentially explosive atmosphere as follows.

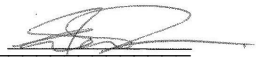
CE Ex **II 2 G c T4**

In addition to compliance with the aforementioned European Standards this equipment meets the requirements of the following internationally recognised standards;

API 6A

I hereby declare that the equipment described in this document has been designed and manufactured in compliance with the relevant sections and essential health and safety requirements of the aforementioned Standards, Codes and Directives / Regulations.

Name Colin McCracken Position Managing Director

Signed: 

17 July 2012

1 Safety

WARNING: Trapped air requires considerable time to compress and when it is compressed is highly dangerous. It has enough stored energy to separate parts with considerable force.

Seals in high-pressure vessels are also susceptible to explosive decompression; the O-rings or rubber gaskets used to seal pressurised pipelines tend to become saturated with high-pressure gases. If the pressure inside the vessel is suddenly released, then the gases within the rubber gasket may expand violently, causing blistering or explosion of the material.

All pressure equipment has a particular pressure rating and care must be taken to ensure that no item is used in a situation that may cause its working pressure to be exceeded.

All personnel involved in pressure testing must be formally trained, competent and utilise the appropriate PPE.

Ensure the identification band/plate is fitted and is displaying the correct information as per the Tag Sheet / Index

This equipment and the equipment it is attached to is heavy never position yourself below a suspended load.

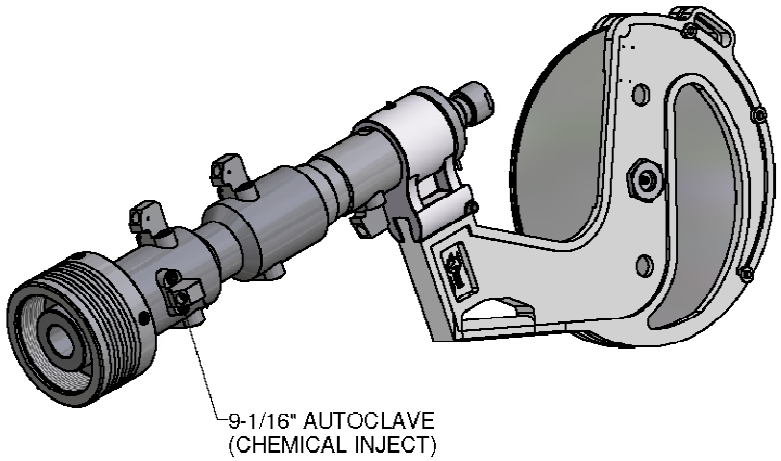


Figure 1: Liquid Seal Stuffing Box Safety

2 Introduction

2.1 General

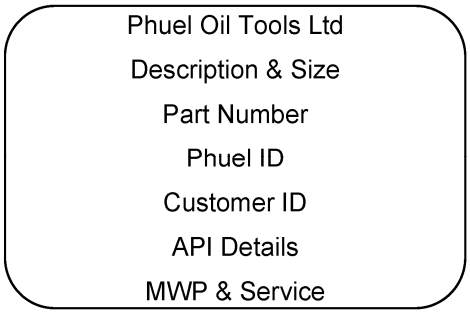
The Phuel Liquid Seal Stuffing Box introduces a truly innovative feature that ensures that Slickline packing can be easily and consistently redressed. The Liquid Seal stuffing box consists of three parts with a connecting sub, pressure sub and top sub allowing for easier handling of the components and easier set up and fitting of the slickline

This user manual serves as an introduction to the equipment and contains specifications, operational, planning and maintenance instructions, parts list and drawings.

2.2 Product Identification

Phuel products are identified by a unique serial number that provides full product traceability. Each product is supplied with a documentation pack that contains product certification and material/inspection reports. The serial number is always etched on the surface of the product but can sometimes be difficult to find or read after painting. A customer identification number is also included to allow the customer to track the asset in their system.

A stainless steel band secures a nameplate tag that is stamped with the information shown below.



3 Technical Specification

Part Number	137-4856-HV0
Connections	7 – 5 Stub Acme ½" NPT (Piston Pressure) 9/16" Autoclave (Grease Injection and monitoring)
Maximum Working Pressure	15,000 Psi
Maximum Test Pressure	22,500 Psi
Service	H2S
Total Weight	258 lbs / 117 kg
Length	59.08" / 1.50m
Make Up Length	56.55" / 1.44m

Table 1: Technical Data

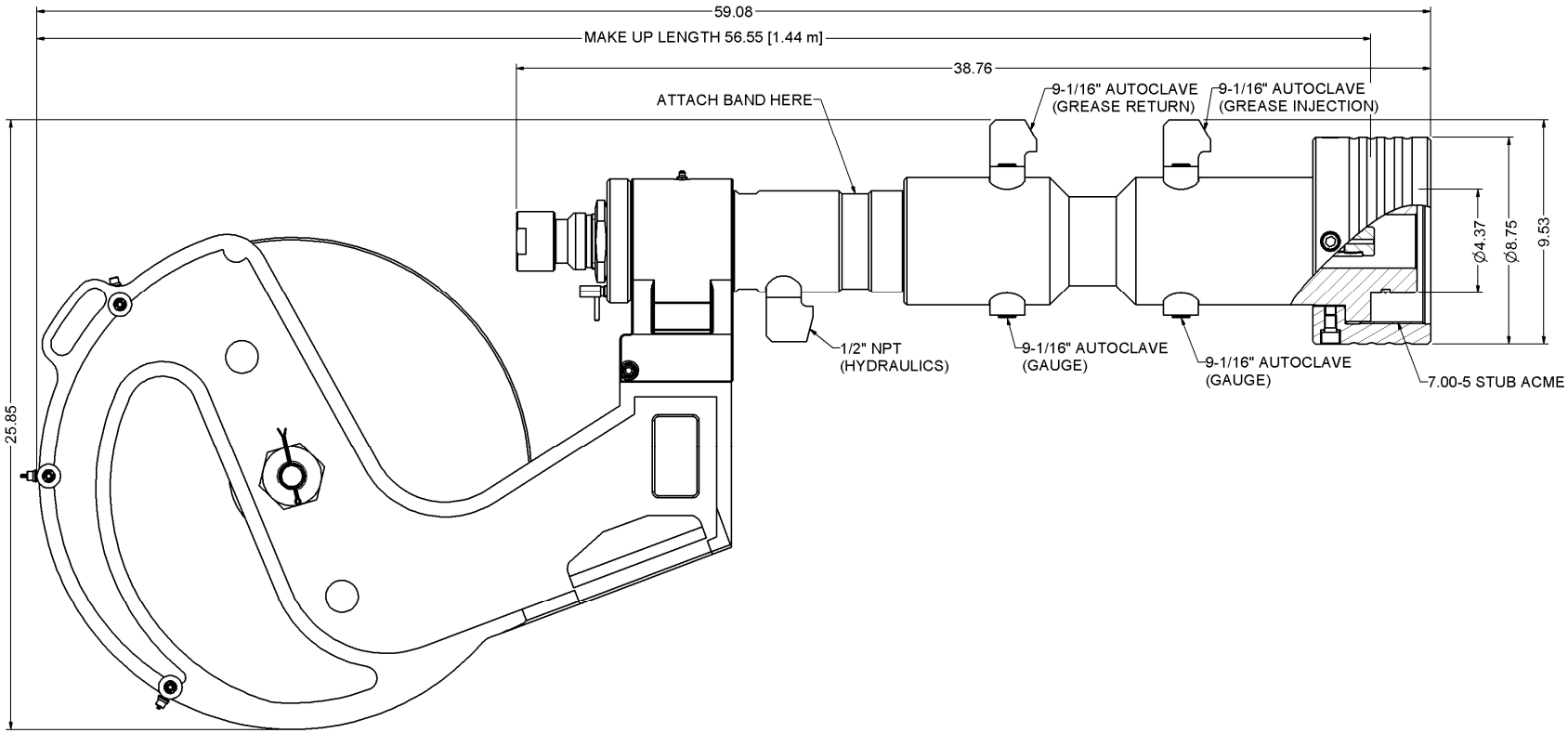


Figure 2: Technical Specification

4 Technical Description

4.1 Description

The liquid seal Stuffing Box provides a pressure seal around stationary or moving slickline that is run into or out of wells to prevent the escape of well fluids to the environment. The assembly consists of a hydraulic pack off and a Flow Tube assembly. This equipment is normally used for high pressure wells as the running friction is much less than conventional Stuffing Boxes.

The flow tube assembly consists of a number of close fitting steel bushes through which the wire line passes. The flow tube is approximately 14.5" long. Viscous grease is injected between the bore of the flow tube and the outside of the wire and travels along the length of the flow tube creating a pressure drop. Grease injection pressure can then be increased to about 25% more than the well pressure to create a liquid seal that allows the wire to move but prevents the escape of well fluids.

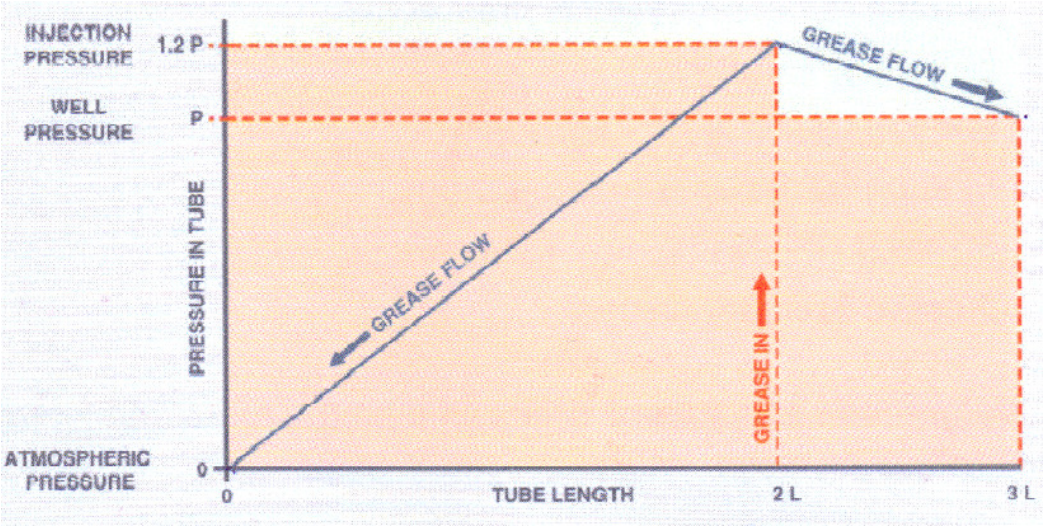


Figure 3: Pressure gradient inside the flow tube assembly

The length of flow tube required depends on the well pressure, the wire size, the flow tube size, the grease viscosity and pump rate and the effectiveness of the seal will depend on the pull out speed of the wire. The relationship for the pressure drop can be expressed mathematically by Couettes flow equation. This shows that the clearance between the wire and the flow tube has a great effect on the pressure drop created as so this is the most important parameter to consider. For slickline the wire diameter is relatively small and the construction of the cable means that the running clearances can be reduced.

This allows a short flow tube stack to be used for high pressures when compared to standard wireline greaseheads.

$$P2 - P1 = \frac{6L\mu Q}{R_c h^3}$$

where

P2 = Grease injection pressure at flotube (psi)
P1 = Grease outlet pressure at flotube (psi)
L = Length of flotube (in)
μ = Grease viscosity (lb / sec / in^2)
h = Flotube ID minus wireline OD (in)
R_c = Wireline radius (in)
Q = Grease flow rate (in^3/sec)

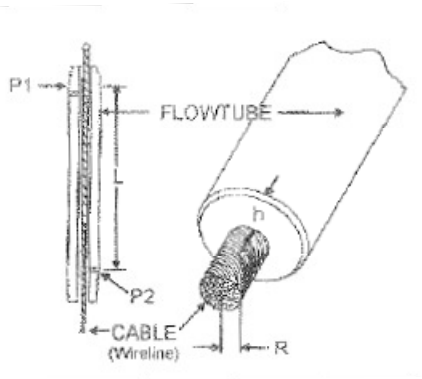
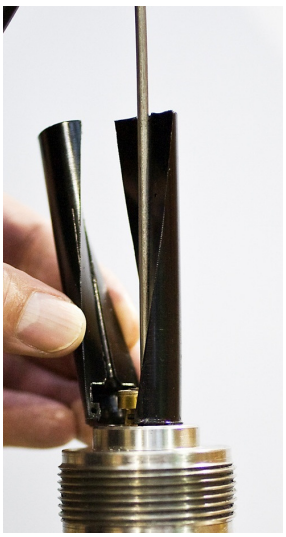


Figure 4: Couettes flow equation

The grease is injected above the first flow tube and exits after the last one. Since the grease is continuously moving and some is being lost to the well, the injection process is continuous and in order to create sufficient flow rate it may be necessary to inject at two locations depending on the well pressure.

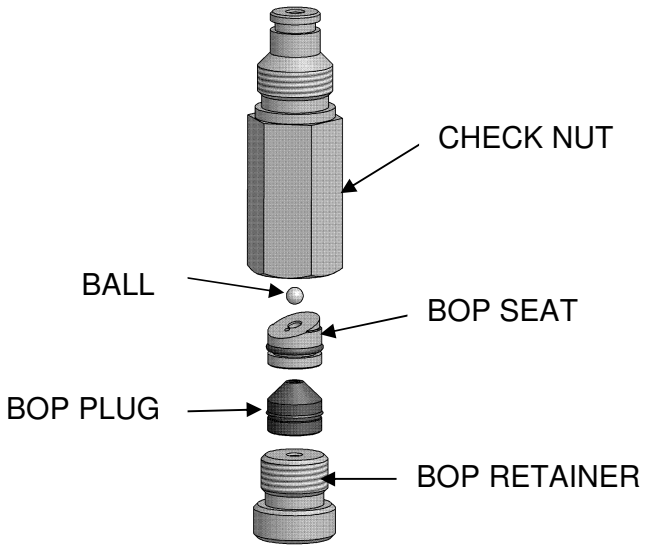
4.2 Packing Stick

The Phuel split packing stick allows for the quick change of the packing stick. This can be achieved by simply pumping out the packing stick allowing it to be quickly replaced and drawn back in when the pressure is bled off.



4.3 Blow out plug

The blow out plug is incorporated so that in the event of a break occurring in the slickline the ball valve will automatically seal containing the well pressure. If the grease seal is lost and the wire is still present the outward flow of well fluids will lift the blow out plug upwards and cause it to grip down and seal against the static wire.



4.4 Easy Assembly

The handling of the liquid seal stuffing box has been reduced so that the inner Flow Housing can be removed from the heavier pressure housing. This allows easy manipulation of the wire through the flow tubes and reduces the risk of damaging the wire during the set up process. A unique hammer design allows the Flow housing to be driven in and out of the pressure housing without the need for excessive effort or special tools.

5 Operation

All operations to be carried out by suitably qualified and competent personnel

5.1 Packing Stick fitting/replacement

- When ready to fit the packing, remove the Top Cap and pump the piston out.
- Fit the two halves of the split packing together and ensure that the pegs and holes are engaged. Bleed off the piston pressure and feed the packing as fully as possible into the housing before fitting wire bush and Top Cap.
- Ensure that the Top Cap is tightened up fully. A wrench will be required for this – hand tight is not sufficient to allow the packing's to take the shape of the housing and to seal on the wire.
- The wire is now ready to be clamped to the riser and the job can continue as normal.

5.2 Pre Job

- Ensure thread protectors are fitted
- Check maintenance record sheet and ensure the equipment has been maintained by competent personnel
- Check all certification is in date
- Confirm information band is fitted and correct
- Ensure equipment is suitable for the maximum working pressures and services involved
- Ensure visible 'O' rings are seated correctly and there are no signs of damage
- Ensure threads are clean
- Inspect for signs of damage
- Pressure test to 1.2x the maximum well pressure

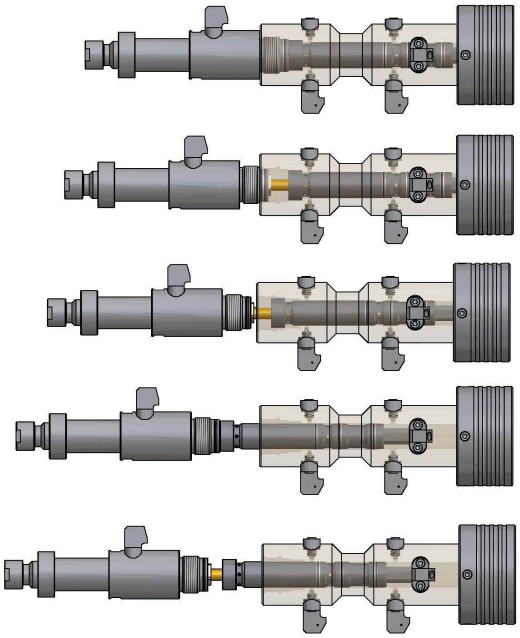
5.3 During Job

- A steady flow of grease is required – Avoid varying the flow rate during operations
- Use the gauge pressure opposite the injection port to set the pressure at 1.2x well pressure.
  - Do not use the gauge on the pump panel as the losses in the hose are significant
- Verify that grease is being returned at the return hose
  - This will be significantly less than is being pumped due to losses into the well
- The packing should only be activated when the line is static

  - Apply piston pressure to a maximum of 2900 psi to energise the packing
  - When no pressure is applied the packing acts as a line wiper to minimise grease spillage
  - Use the brass washer for most operations to reduce line friction
- Avoid excessive movement

5.4 Post Job

Upon completion of the job the stuffing box must be split back down into its three subs to allow for post use checks to be carried out.
To make this easier the stuffing box has a built in hammer action to assist in the withdrawal of the Flow Housing. This is achieved by unscrewing the Packing Housing from the Pressure Housing and using a hammer type action to drive out the Flow Housing.



- Inspect for signs of damage
- Ensure threads are clean
- Ensure thread protectors are fitted

6 Maintenance

All maintenance to be carried out by suitably qualified and competent personnel

6.1 Introduction

Regular maintenance of the equipment using Phuel redress kits or Phuel approved parts is essential to its continued safe operation. Ensure that the pre and post job operating procedures are followed and that maintenance records are kept.

6.2 Schedule

The maintenance schedule may be governed by international or company standards and the following is considered to be the minimum requirements.

6.2.1 Pre & Post Job

Refer to Section 5.2 and Section 5.4 for details

6.2.2 Yearly

- Disassemble Liquid Seal Stuffing Box clean and degrease all components
- Inspect the condition of all sealing surfaces and surface coatings
- Re-coat threads and sealing surfaces if necessary. If in doubt contact Phuel Oil Tools Ltd
- Replace all elastomeric seals with items from redress kit
- Re-grease components
- Re-assemble
- Pressure test to maximum working pressure in accordance to testing procedure
- Inspect paint work and repair as necessary

6.2.3 Five Yearly

- Yearly Maintenance (plus the following)
- Carry out 100% surface NDE on all surfaces
- Pressure test to test pressure witnessed by verifying body

6.3 Safety

- Many of the components are heavy and should not be lifted without lifting aids.
- Ensure all pressure testing is carried out in the appropriate testing area by suitably qualified personnel.

- Wear appropriate personal protective equipment.
- Do not over exert yourself while using torque wrenches. Use appropriate mechanical advantages when available.
- Ensure that all tools and equipment are in good condition and are suitable for the intended use.
- Clear up any fluid spills immediately to avoid slips.

6.4 Tools

The following tools are required:

- Memac Chain Wrench (No2 with 14'' chain)
  Other pipe wrenches may be used but will mark equipment
- ½'' hex Allen key
- 3/8'' hex Allen key
- ½'' Spanner
- ¾'' Spanner
- Pin punch
- Hammer
- Wire Brush

6.5 Redress Procedure

Follow the diagram that follows.

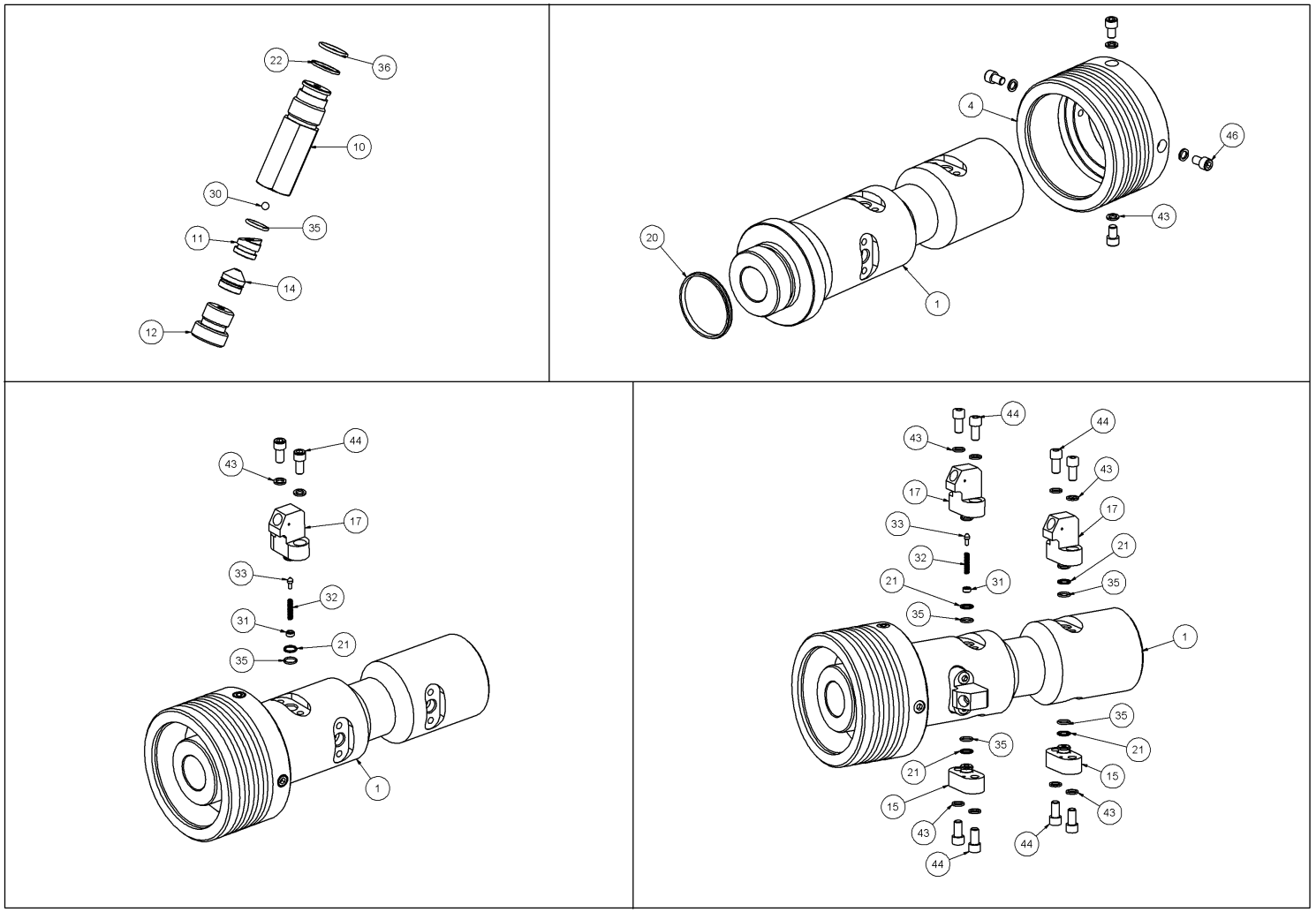


Figure 5: Assembly Instruction – part 1

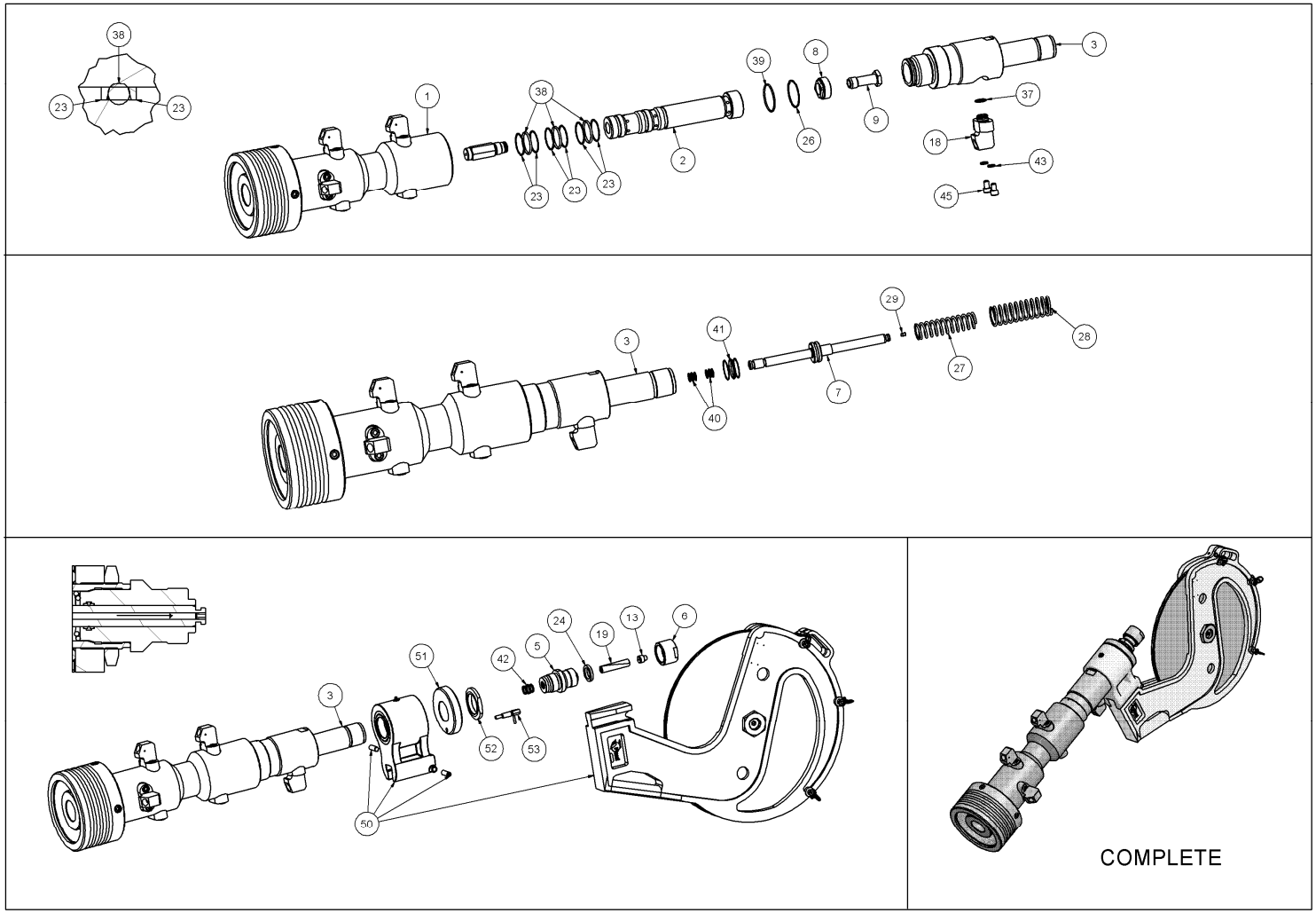


Figure 6: Assembly Instruction – part 2

6.6 Maintenance Record Sheet

Date Performed	Type of Maintenance	Performed By	Verified By	Comments

Example

Table 2: Maintenance Record

7 Testing

All testing is to be carried out in the designated test area and by suitably qualified and competent personnel.

WARNING: Trapped air requires considerable time to compress and when it is compressed is highly dangerous. It has enough stored energy to separate parts with considerable force.

- Fit appropriate test cap and blanks
- Fill with testing fluid bleeding off any air within the system
- Apply a pressure of 500 psi and ensure pressure holds for a minimum of 10 minutes
- Increase pressure to 15,000 psi (Maximum Working Pressure), allow to stabilise and maintain this pressure until it is evident there are no apparent leaks.(Testing to be carried out to Test pressure when decreed by maintenance schedule)
- Bleed off pressure, drain test fluid and dry
- Remove test caps
- Apply coating of de-watering solution to protect the bore and threads
- Fit thread protectors

On completion of all maintenance ensure the maintenance record sheet (6.6) is completed

8 Parts List and Drawings

Item Number	Part Number	Description	Quantity
1	137-3133-480	PRESSURE HOUSING	1
2	137-4913-480	ONE PIECE FLOW TUBE FOR 0.160 WIRE	1
3	137-4914-480	LIQUID HOUSING FOR SHEAVE BRACKET	1
4	145-3128-480	SOLID COLLAR 7"-5	1
5	100-1975-480	PACKING HOUSING	1
6	100-2033-480	TOP CAP	1
7	137-4494-480	LIQUID SEAL PISTON V2	1
8	137-3137-480	HAMMER CUP	1
9	137-3140-B21	HAMMER	1
10	137-3136-B21	CHECK NUT	1
11	137-5111-B21	SPECIAL 0.160 BOP SEAT	1
12	100-1988-B21	BOP RETAINER	1
13	137-5112-B21	SPECIAL 0.160 WIRE BUSH	1
14	100-3428-PU9	BLOW OUT PLUG	1
15	110-2986-480	SAVER SUB (15K WP)	2
17	900-3020-480	HP CHECK HOUSING	3
18	900-3019-480	CHECK HOUSING	1
19	100-3476-PU8	S-BOX PACKING STICK (0.160)	1
20	803-3186-V90	SPRING SEAL FOR 7-5 CONNECTION	1
21	801-3126-PEK	BACKUP (114)	5
22	801-4564-PEK	BACK UP (118) (15 DEGREE ANGLE)	1
23	801-4565-PEK	BACK UP (226) (15 DEGREE ANGLE)	6
24	100-2696-STL	SPACER	1
26	801-4566-PEK	BACK UP (232) (15 DEGREE ANGLE)	1
27	100-2693-STL	INNER SPRING (RIGHT HAND)	1
28	100-2692-STL	OUTER SPRING	1
29	137-5113-B21	SPECIAL 0.160 PISTON PLUG	1
30	100-2211-316	BALL BEARING 0.250 DIA	1
31	190-3200-STL	HOLLOW LOCK SCREW (MAC-655)	2
32	100-2212-STL	COMP SPRING (C6611230)	2
33	100-2114-PEK	CHECK VALVE SEAL	2
35	801-0114-V90	O-Ring - B.S Size 114	6
36	801-0118-V90	O-Ring - B.S Size 118	1
37	801-0119-V90	O-Ring - B.S Size 119	1
38	801-0226-V90	O-Ring - B.S Size 226	3
39	801-0231-V90	O-Ring - B.S Size 231	1
40	802-1999-H80	PISTON T-SEAL 0.75	2
41	802-1998-H80	PISTON T-SEAL1.75	1
42	802-1997-H80	ROD T-SEAL 0.754	1
43	WNL-0580-316	WASHER NORDLOCK (M12)	16
44	SHC-0585-AL7	SOC HD CAP SIZE 1/2 LENGTH 1"	10

Item Number	Part Number	Description	Quantity
45	SHC-0583-3A4	Soc Hd Cap 1/2 UNC Length 3/4 in	2
46	SHC-0583-316	Soc Hd Cap 1/2 UNC Length 3/4 in	4
50	100-5245-HV0	SHEAVE WHEEL + STD + NEW PINS	1
51	100-1981-316	LOCK RING	1
52	100-1986-316	LOCKNUT	1
53	100-1943-304	SPRING PLUNGER L HANDLE LOCKING	1
100	910-3129-N66	7-5 ACME MALE PROTECTOR	1

Table 3: Parts List 137-4856-HV0

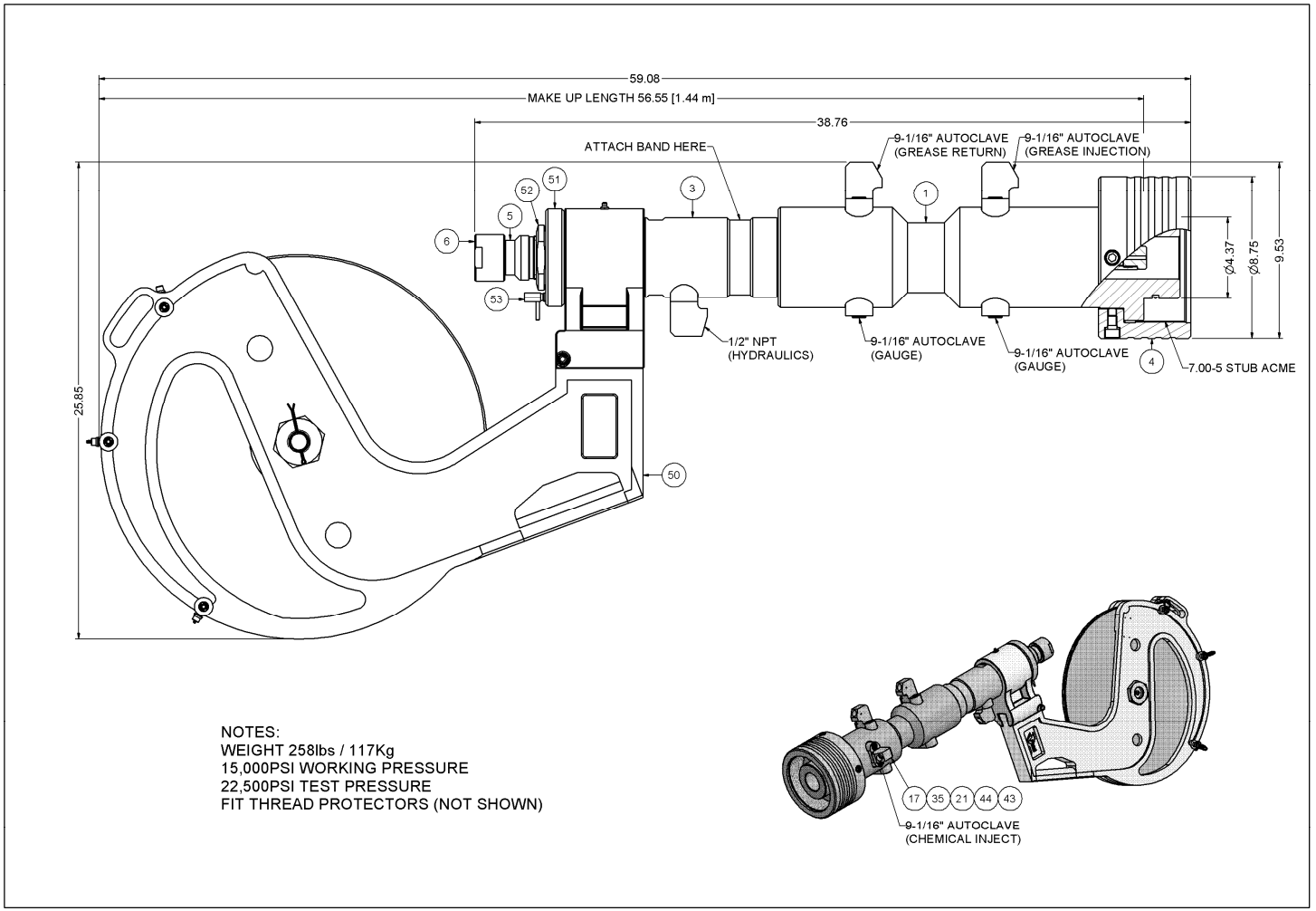


Figure 7: Liquid Seal Stuffing Box Assembly 1

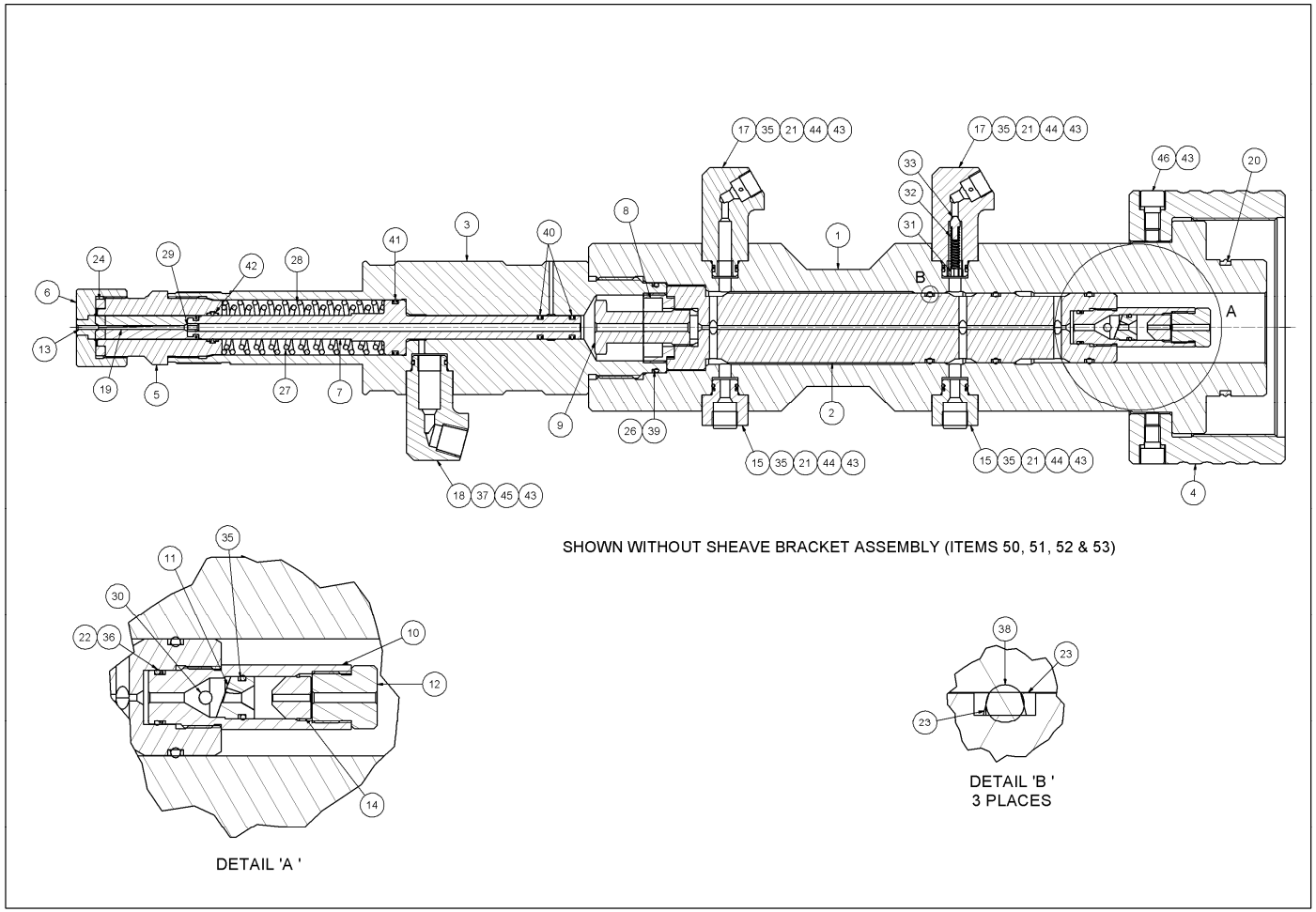


Figure 8: Liquid Seal Stuffing Box Assembly 2

Item	Part Number	Description	Quantity
13	100-2037-ALU	BEARING HUB	1
14	100-2094-N66	DUST SEAL	2
29	100-2039-STL	TAPERED ROLLER BEARING (32012XA)	2
33	100-3298-A69	SHEAVE BRAKET 20"	1
34	100-3432-ALU	20" Sheave Wheel	1
35	100-2205-316	BEARING SHAFT	1
36	100-2206-316	BEARING NUT	1
37	100-2207-STL	ROLLER BEARING (NUP308-E-TVP2)	1
38	100-5126-316	QR1087.25-175 RECESSED HANDLE QUICK	3
39	145-2215-304	SPLIT COTTER PIN 1/8 X 3 LONG	1
40	100-2179-STL	GREASE NIPPLE 1/8 NPT	2
41	801-0155-N70	O-Ring - B.S Size 155	2
44	SDU-0503-HTS	Set Screw Dog Point Size 1/4 Length 0.5 in	3
45	SCU-0587-3A4	Set Screw Cup Point 1/2 UNC x 1.25 Long	2
55	100-5107-316	PIN RETAINER	3
56	SHC-0503-HTS	Soc Hd Cap Size 1/4 Length 0.5 in	3
57	WNL-0500-316	1/4" Nordlock Washer	3
58	950-5248-316	LANYARD 1" X 10mm RING	3

Table 4: Parts List 100-5245-HV0

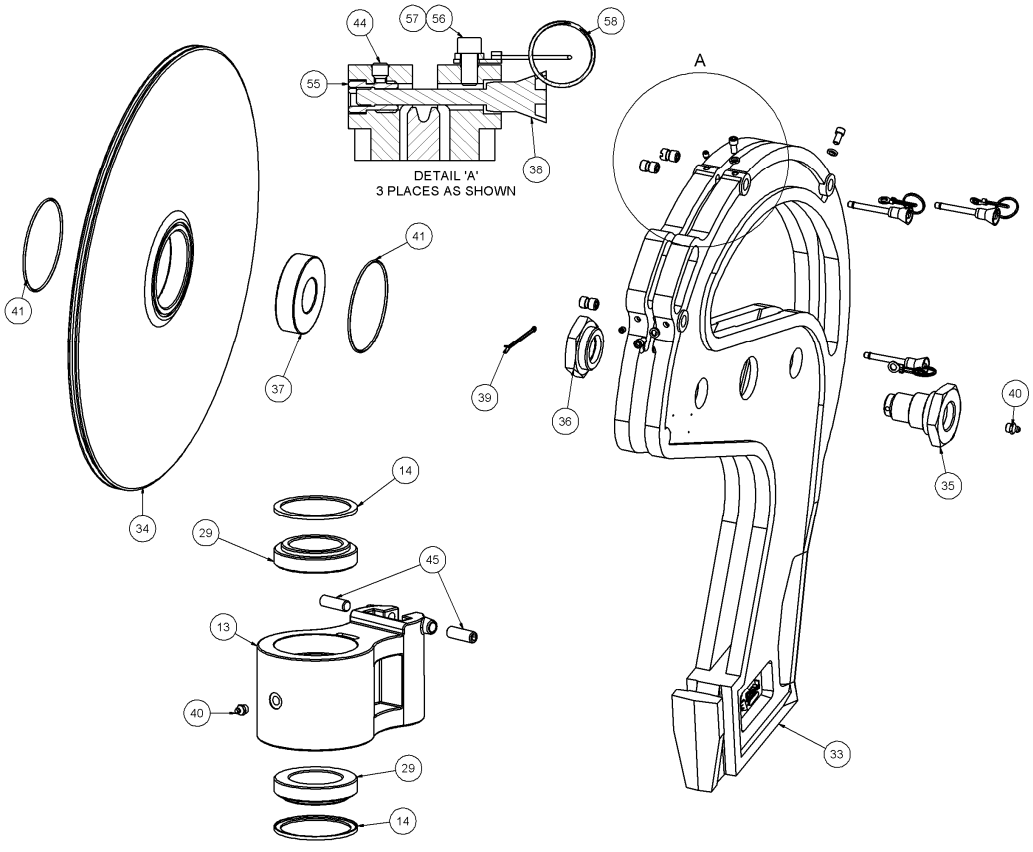


Figure 9: 100-5245-HV0 Assembly

9 Spares

Use only spares supplied or approved by Phuel Oil Tools Ltd.

It is recommended that sufficient quantities of the following spares be maintained to ensure that the equipment is always available when required.

Elastomeric spares are supplied in Viton/HNBR material as standard. Many other materials are available please specify when ordering.

Part Number	Description	Quantity
803-3186-V90	SPRING SEAL FOR 7-5 CONNECTION	1
801-3126-PEK	BACKUP (114)	5
801-4564-PEK	BACK UP (118) (15 DEGREE ANGLE)	1
801-4565-PEK	BACK UP (226) (15 DEGREE ANGLE)	6
801-4566-PEK	BACK UP (232) (15 DEGREE ANGLE)	1
801-0114-V90	O-Ring - B.S Size 114	6
801-0118-V90	O-Ring - B.S Size 118	1
801-0119-V90	O-Ring - B.S Size 119	1
801-0226-V90	O-Ring - B.S Size 226	3
801-0231-V90	O-Ring - B.S Size 231	1
802-1999-H80	PISTON T-SEAL 0.75	2
802-1998-H80	PISTON T-SEAL1.75	1

Table 5: Redress Kit Part No RDK-4856-HH0

9.1 Individual Items

Individual items may be ordered as required using the part number specified

Note: O-Rings conform to industry standards and may be substituted with those from other suppliers – **at the sole risk of the user**.

9.2 Supporting Items

Part Number	Description	Comments
950-5108-STL	HANDLING SPANNER	For breaking the connection between the Liquid Housing (item 3) and the Pressure Housing (item 1)